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THE CALIFORNIA FEED-LIVESTOCK BALANCE IN 1961-65

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FOREWARD

This study is a contribution to a series of publications relating to projections of California agriculture to 1980. One purpose of this report is to provide a base point for appraising the future of the feed-livestock economy of California. It provides detailed estimates of the supply and disposition of feed concentrates for the 1961-1965 average, including feed grains, high-protein feeds, and other by-product feeds. Less detailed information is given for hay and silage supply and disposition. A second purpose is to provide estimates of feed use by individual classes of livestock. A third aspect deals with trends in the consumption of livestock products in the United States, the sources of supply of these products for California, and the factors that influence the composition of livestock production in California. The authors gratefully acknowledge the helpful suggestions of the reviewers, and the typing of the manuscript by Mrs. Taina Nordbak.

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THE CALIFORNIA FEED-LIVESTOCK BALANCE IN 1961-1965

by

Gary Snider* and Gordon A. King**

INTRODUCTION

California producers of feed grains and producers of livestock products are continually appraising the future of these industries in this state and in competing producing areas of the country. Processing and marketing agencies also are concerned with factors that may change these industries. It is clear that the demand for most livestock products will continue to increase with rising income and population levels. Similarly, the derived demand for feed concentrates will increase, moderated by increased feed conversion efficiency. But the increased levels of demand do not necessarily mean similar production increases in California, as evidenced by (a) the current feed deficit position of the state for livestock feeding and (b) the competition from other regions in the production of meat and other livestock products.

The purpose of this report is to provide a base point for appraising the future of the feed-livestock economy of California. It provides detailed estimates of the supply and disposition of feed concentrates for the period 1961-1965, including feed grains, high-protein feeds, and other by-product feeds.[1] Less detailed information is given for hay and silage supply and disposition. A second purpose of this study is to estimate use of feed by

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[1]Information for individual years on feed grain supply and disposition is given in the annual reports published by the Federal-State Market News Service [1969]. These reports do not include production and use of by-product feeds.

individual classes of livestock based on feeding rates and livestock numbers, and to balance this estimated use with the total reported utilization for livestock feeding. This information has been used in making projections of livestock production and feed requirements for 1980 and 2000 and is reported in a forthcoming study by Dean, et al., [1970]. A third aspect of the report deals with trends in consumption of livestock products in the United States, and factors that influence the composition of livestock production in California. For example, California produces only two percent of its pork supply, whereas it is a net exporter of eggs. Thus, the purpose of the report is to provide an overview of the feed-livestock economy of California using detailed estimates for the 1961-1965 period to indicate factors that have influenced the level and composition of livestock production in the state and the related derived demand for feed concentrates and hay. This information should be of use in analyzing current trends in these industries.[1]

CALIFORNIA FEED SUPPLY AND UTILIZATION

Feed Concentrates

Feed grains account for about 62 percent of concentrates fed to livestock, with by-product feeds and wheat the remainder. By-products are classified into two general groups -- high protein and "other." The high protein group includes cottonseed meal, soybean meal, copra meal, meat scraps and tankage, fish meal, and brewer's dried grains. The "other" by-products include dried beet pulp, wheat and rice millfeeds, alfalfa meal, and molasses.

Barley and grain sorghums are the major feed grains fed to poultry and livestock in California. Of the average 4.3 million tons of feed grains fed annually in 1961-1965, grain sorghums accounted for 43 percent; barley, 40 percent; corn, 14 percent; and oats, 3 percent. In recent years, consumption of barley has been about equal to that produced in the state, whereas California production of sorghum grains is about one-fourth of the quantity fed (see Figure 1).

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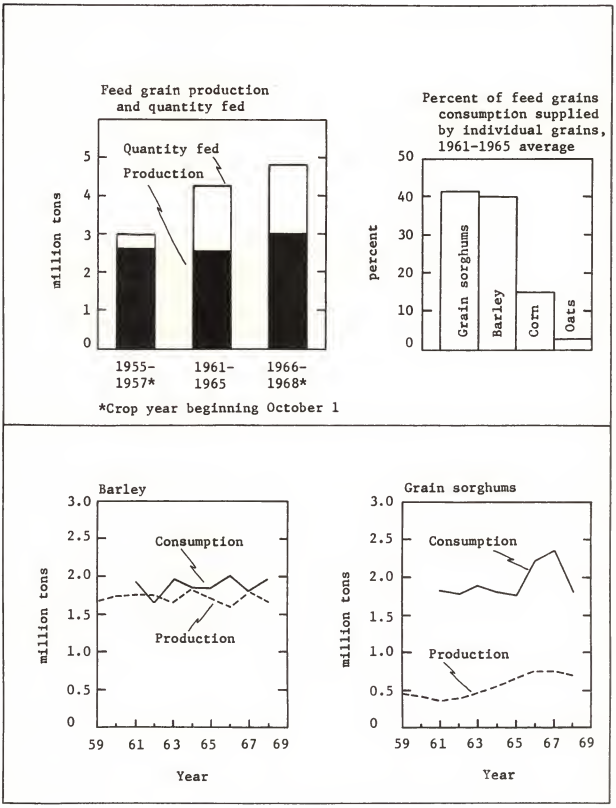
[1]More detailed information on corn is available in a report by Siebert and Courtney [1967].

FIGURE 1

California Feed Grain Production and Quantities Fed, 1955-1957, 1961-1965, and 1966-1968; and Production and Consumption of Barley and Grain Sorghums, 1959-1969



Source: California Crop and Livestock Reporting Service [1969c] and Federal-State Market News Service [1969].

The growth of the poultry and livestock industries that has occurred in the past 15 years has been accompanied by increased reliance on feed grains shipped into the state. The comparison of the 1955-1957 period with 1961-1965, as shown in Figure 1, indicates the sharp increase in levels of feeding but not in production. However, for the 1966-1968 period, California production of grain sorghums and corn are higher than for the 1961-1965 period whereas shipments from other states for feed use are about the same as in 1961-1965. It should be noted that these data do not include feed wheat, which is of increased importance in some areas of the state. Since accurate data are not available on the use of wheat for feed, it is included in the by-product feed category. A brief discussion is given below of the major components of the feed concentrate supply and distribution.

Feed Grains

Production.--Feed grain production was 2,573,400 tons for the 1961-1965 average as compared with livestock feeding of 4,258,200 tons (see Table 1). Barley accounted for 68 percent of California feed grain production. Barley production has remained fairly constant between 1955 and 1968 (range in production between 1.6 and 1.8 million tons). Although acreage has decreased, this has been offset by increased yields. For the other grains, grain sorghum acreage, yield, and production have trended upward, with 1968 production at 705,600 tons as compared with 493,600 tons in 1961-1965 and 313,100 tons in 1955-1957. Corn production, which was low during the 1961-1965 period, is currently slightly above that in 1955-1957. Production of oats has decreased from the 1961-1965 level of 91,000 tons to 69,400 tons in 1966-1968.

Shipments into California.--A substantial amount of feed grains is shipped into California yearly. In 1961-1965, inshipments equaled 2.1 million tons as compared with production of 2.6 million tons. Sorghum grain is the major grain shipped into California, mainly from Texas and Oklahoma but also from the Midwest.[1] Most of the corn is shipped from

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[1]Truck and rail shipments are reported by the Federal-State Market News Service [1969]. Sources of truck inshipments and counties of destination are reported in the monthly reports of the Federal-State Market News Service [1967]. Sources of rail inshipments are available from the one percent sample of carload waybill statistics, U.S. Interstate Commerce Commission [1966b].

TABLE 1

California Feed Concentrate Supply and Distribution, 1961-1965 Average[a/]

Item	Supply				Distribution				
	Beginning stocks January 1	Production	Imports, inshipments	Total supply	Ending stocks	Exports	Seed	Food and industry	Livestock feed
	thousand tons								
Feed grains									
Barley	647.5	1,754.8	203.6	2,605.9	641.3	78.3	71.3	108.6	1,706.4
Grain sorghum	785.5	493.6	1,419.1	2,698.2	646.0	218.7	2.5	--	1,831.0
Corn	121.2	233.1	446.3	800.6	129.2	16.0	1.4	46.5	607.5
Oats	32.8	91.9	42.4	167.1	33.0	--	16.6	4.2	113.2
Total	1,587.0	2,573.4	2,111.4	6,271.8	1,449.5	313.0	91.8	159.3	4,258.2
Wheat used as feed	--	16.5[b/]	--	16.5[b/]	--	--	--	--	16.5
High-protein by-products	--	663.5	211.1	874.6	--	--	--	--	874.6
Other by-products	--	1,225.1	476.0	1,701.1	--	2.5	--	--	1,698.6
TOTAL	1,587.0	4,478.5	2,798.5	8,880.5	1,449.5	315.5	91.8	159.3	6,847.9

a/ Based on data reported by the Federal-State Market News Service [1969]; data on production are revised estimates of the California Crop and Livestock Reporting Service [1969c]; estimated seed use is based on succeeding year's planted acreage; and estimated food and industry use is based on information from grain merchandisers and information provided by the California Brewer's Association.

b/ Estimated use for feed.

Nebraska, Kansas, and Iowa. Corn shipments in 1961-1965 were almost double California production, whereas currently, production exceeds inshipments. Shipments of oats and barley are of less importance than corn and sorghum grain. The nearby western states are the source of these shipments.

Total supply.--The total supply and distribution of feed grains is summarized Table 1 for the 1961-1965 period. Brief comments are provided below on the estimation of use for seed, food and industry, and feed since data are not reported separately. Exports, however, are reported annually.

Exports.--Exports of feed grains are relatively small, accounting for about five percent of the California total supply in 1961-1965. Grain sorghum accounted for nearly two-thirds of feed grain exports in this period.

Seed use.--The use for seed was estimated by applying the average California seeding rate of each grain to the succeeding year's planted acreage.

Food and industrial use.--The estimated quantities of feed grains used for food and industrial purposes include only the major uses of each grain. The lack of comprehensive data prevents accurate estimation of such uses. The quantities given in Table 1 are either published figures from the industry, estimates obtained from industry sources, or a combination of both. Barley and corn estimates refer to that used by the brewing industry, which is the major food and industrial use in the state. Some additional quantities of barley are used in soup preparation and other minor uses. The varieties of oats grown in California generally are not used for food or industrial uses, and an estimated 10 percent of inshipments are so used. The majority of products which use substantial quantities of oats or corn for cereals, distilled liquors, etc., are processed in other states. It is estimated that sorghum grain is used almost exclusively for livestock feed rather than for other industry use in California.

Feed use.--The remaining quantity is estimated to be available for livestock feeding. This quantity may include amounts wasted as well as that actually consumed by livestock. The importance of barley and sorghum grains is apparent from inspection of Table 1.

By-product Feeds

By-product feeds fed to livestock and poultry for the 1961-1965 average equaled 2.6 million tons, or 38 percent of all concentrates fed in California. These feeds are important to obtain rations with the desired levels of protein and other nutrients for growth and production. Production of by-products in the state generally is a function of the demand for the primary product of each, such as cotton (cottonseed meal) and sugar (beet pulp). California produces about 70 percent of its requirements for livestock feedings, with the remainder imported from abroad or shipped in from other states. Estimates of production, supply, and utilization (see Table 2) are obtained from various sources, and some figures are estimates rather than reported production levels. Thus, these data are less reliable than for the feed grains.

High-protein by-products.--This group includes the oilseed meals (cottonseed, soybean, and copra), meat meal, fish meal, and brewer's dried grains. Cottonseed meal is the major high-protein feed produced in California, but additional quantities are shipped in from other states. Inshipments are the major source of soybean meal. Copra meal is produced in the state from imported copra. Fish meal also is imported in substantial quantities and is important for poultry rations. The total used in livestock feeds is estimated at 874,600 tons for the 1961-1965 period, an amount that is about 20 percent of the feed grain tonnage, but these feeds are important for balanced rations especially for poultry.

Other by-products.--Alfalfa meal and dried beet pulp are obtained from California production. Millfeed and molasses also are produced in the state, but inshipments of millfeeds and imports of molasses exceed production (see Table 2). Small quantities of alfalfa meal and molasses are shipped out of the state. Supplies of these feeds are about twice that of the high-protein feeds.

Hay and Roughage

The supply and distribution of hay and silage for the 1961-1965 period are given in Table 3. Alfalfa hay accounts for about 85 percent of the total produced in California. It is the only hay or roughage shipped into the

TABLE 2

California By-Product Feed, Supply, and Distribution, 1961-1965 Average

Item	Production	Imports and inshipments	Total supply	Exports	Livestock feed
	thousand tons				
High-protein by-products					
Soybean meal	23.6	145.9	169.5	--	169.5
Cottonseed meal	330.7	30.2	360.9	--	360.9
Copra meal	104.0	--	104.0	--	104.0
Meat meal and tankage	98.6	--	98.6	--	98.6
Fish meal and solubles	46.0[a/]	35.0	81.0	--	81.0
Brewer's dried grains	20.2	--	20.2	--	20.2
Others	40.4	--	40.4	--	40.4
Total	663.5	211.1	874.6	--	874.6
Other by-products					
Alfalfa meal	405.0[b/]	--	405.0	1.5	403.5
Dried beet pulp	389.0	--	389.0	--	389.0
Millfeeds	223.0	241.0	464.0	--	464.0
Molasses	208.1	235.0	443.1	1.0	442.1
Total	1,225.1	476.0	1,701.1	2.5	1,698.6
TOTAL	1,888.6	687.1	2,575.7	2.5	2,573.2

a/ 1961-1964 data only.

b/ 1963-1965 date only.

Source:

Production

Alfalfa meal production figures are from Alfalfa Hay, California Market Summary, Federal-State Market News Service, [1966].

Beet pulp production figures were obtained by a telephone interview with Spreckels Sugar Company, San Francisco, California.

Brewer's dried grain was estimated by applying California's percent of U.S. beer production to the quantity of brewer's dried grain used as feed in the U.S. California's percent of U.S. beer production was provided by the California Brewers Association, [1967]; the quantity of brewer's dried grain used as feed in the U.S. is found in the Feed Situation, U.S. Economic Research Service, [1966].

Copra meal production was estimated from imports of copra and consequent production of the meal in the U.S. The imports of copra are presented in Waterborne Commerce of the United States, U.S. Army Corps of Engineers, [1964]. The production of copra meal is found in U.S. Fats and Oils Statistics, U.S. Department of Agriculture, [1966].

Cottonseed meal and cake production is listed in Current Industrial Reports, Fats and Oils, Vegetable Oil Crushers, U.S. Bureau of the Census, [1965e].

Fish meal and soluble production was estimated by using California's percent of U.S. annual catch, U.S. Department of the Interior, [1966]. This figure was then applied to the U.S. meal-scrap production from U.S. Fish Meal and and Scrap Production, 1929-1964, U.S. Department of the Interior, [1965c].

Hay and silage are given in California Field Crop Statistics (1957-1966), California Crop and Livestock Reporting Service, [1969c], and Alfalfa Hay, California Market Summary (1963-1965), Federal-State Market News Service, [1966].

Meat meal and tankage was estimated from California's percent of U.S. commercial slaughter given in Livestock and Meat Statistics, 1961-1965, U.S. Department of Agriculture, [1967]. The U.S. production of meat meal and tankage is given in Meat Meal and Tankage Production, Semiannual Report, U.S. Statistical Reporting Service, [1965].

The millfeed production in California applies to wheat and rice. The wheat millfeed is found in Current Industrial Reports, Flour Milling Products, U.S. Bureau of the Census, [1965b]. The rice millfeed was estimated by applying California's percent of U.S. rice production to the U.S. rice millfeed production. The U.S. and California rice production is found in Crop Production, 1961-1966, U.S. Statistical Reporting Service, [1967]. The U.S. production of rice millfeed is found in the Feed Situation (1961-1965), U.S. Economic Research Service, [1966].

Molasses is made up of corn, sugarbeet, and citrus. The corn molasses production was estimated by applying California's percent of the U.S. wet-process production to the U.S. production of hydrol. The U.S. wet-process production figures are found in Feed Situation (1961-1965), U.S. Economic Research Service, [1966]. The California percent of U.S. production is estimated in the 1963 Census of Manufacturers, U.S. Bureau of the Census, [1966]. The U.S. production of hydrol comes from the Molasses Market News, Annual Summary, 1966, U.S. Consumer and Marketing Service, [1967]. The beet molasses was estimated by applying the California percent of U.S. sugar beet production to the U.S. beet molasses production. The sugar beet production is found in the Crop Production, 1961-1966, U.S. Statistical Reporting Service, [1967], while the beet molasses is found in Molasses Market News, U.S. Consumer and Marketing Service, [1967]. The citrus molasses production was estimated in the same manner as the beet molasses with the same sources of information.

Soybean meal production in California was estimated from the 1963 Census of Manufacturers, U.S. Bureau of the Census, [1966].

Inshipments - Imports

Cottonseed meal and cake inshipments are estimated from Carload Waybill Statistics, U.S. Interstate Commerce Commission, [1966b].

The imports of fish meal end solubles are estimated in the same manner as the fish meal and soluble production. The U.S. figures on imports are from Imports of Fish Meal end Scrap, 1937-1964, U.S. Department of the Interior, [1965b].

Millfeeds shipped into California are estimated from the Carload Waybill Statistics, U.S. Interstate Commerce Commission, [1966a], as were the cottonseed meal and cake shipments.

The import figures of molasses into California came from Waterborne Foreign Trede Through the Californie Customs Districts, Bank of America, [1965].

The soybean meal inshipment figures were obtained through e telephone interview with the Bureau of Market News in Sacramento, California.

Exports

Alfalfa meal export figures were estimated es the difference between alfalfa pellets exported and alfalfa meal and pellets exported, as reported in Alfalfe Hey, California Market Summery, Federal-State Market News Service, [1966].

TABLE 3

California Hay and Roughage Supply and Distribution, 1961-1965 Average

Item	Production	Inshipments	Exports	Livestock feed
	thousand tons			
Hay				
Alfalfa	6,223.4	166.9[a/]	226.8[b/]	6,163.5
Grain	740.4	--	--	740.4
Other tame	316.6	--	--	316.6
Wild	130.2	--	--	130.2
Total	7,410.6	166.9	226.8	7,350.7
Roughage				
Silage	1,557.0	--	--	1,557.0
Cottonseed hulls	153.1[c/]	--	--	153.1
Total	1,710.1	--	--	1,710.1
TOTAL	9,120.7	166.9	226.8	9,060.8

a/ 1963-1965 average (hay).

b/ 1964-1965 average (pellets).

c/ Estimate based on cottonseed production.

Source: Hay, silage production - California Crop and Livestock Reporting Service, [1969c].

Hay, silage inshipments - Federal-State Market News Service, [1966].

Cottonseed production - U.S. Bureau of the Census, [1965a].

state, amounting to 166,900 tons in 1961-1965. Arizona and Nevada are the major sources of shipments. Alfalfa pellets are exported from California, amounting to 226,800 tons in the 1961-1965 period. In more recent years, both exports and inshipments have increased. For 1968, exports were 345,000 tons and shipments into California were 194,000 tons.

Corn silage production was 1.3 million tons in 1961-1965 and 1.8 million tons in 1966-1968. Sorghums for silage have remained at a level of about 250,000 tons in recent years. Although cottonseed hulls are not an important roughage supply, feedlots use a substantial quantity. Hopkin and Kramer [1965] report the average feedlot use to be 0.8 percent of the total ration for cattle on feed.

ESTIMATED FEED USE BY TYPE OF LIVESTOCK AND POULTRY

Feed Concentrates

The purpose of this section is to develop estimates of feed use by individual types of livestock, given the aggregate feed use developed in the previous section. The procedure involved: (1) determining the number of poultry and livestock fed annually in 1961-1965; (2) obtaining from various sources appropriate rations (feed grains, high-protein feeds, and other by-products) by type of livestock; and (3) calculating the total concentrates fed per year such that this total would equal the aggregate available for feeding. It is clear that the determination of "typical" state-wide livestock and poultry rations poses a difficult task, and one that may be subject to error. The primary source used for feed formulas for the various types of livestock is a report by Thomas and Braun [1965] entitled Utilization of Feedstuffs by California Feeding Industries, Calendar Year 1963. Additional information was used from various publications cited and interviews with several poultry and livestock production specialists. However, adjustments were made by the authors such that the feed use balanced with the supply.

The number of head fed and estimates of concentrates fed are given in Table 4. Livestock and poultry numbers for the 1961-1965 average are from various reports of the California Crop and Livestock Reporting Service except where noted. Exceptions include beef cattle heifer replacements

TABLE 4

Feed Concentrates Fed to Poultry and Livestock by Kind: Concentrates Per Head, Concentrate Ration, and Total Concentrates Fed, 1961-1965 Average

Type of animal	Number of head fed	Concentrates fed per head				Concentrate ration				Total concentrates fed			
		Feed grains	High-protein by-products	Other by-products	Total	Grain	High-protein	Other	Total	Feed grains	High-protein by-products	Other by-products	Total
	(thousands)	pounds				percent				thousand tons			
Beef cattle													
Feedlot marketings	1,957	1,482.0	84.0	784.0	2,350.0	63	4	33	100	1,450.0	82.2	767.1	2,299.3
Beef cows, 2 years +	889	22.5	90.0	--	112.5	20	80	--	100	10.0	40.0	--	50.0
Heifer replacements, 1-2 years a/	308	--	--	--	--	--	--	--	--	--	--	--	--
Calves raised	(785)	--	--	--	--	--	--	--	--	--	--	--	--
On feed b/	200	600.0	225.0	--	825.0	73	27	--	100	60.0	22.5	--	82.5
Other	585	--	--	--	--	--	--	--	--	--	--	--	--
Bulls c/	36	--	--	--	--	--	--	--	--	--	--	--	--
Dairy cattle													
Cows	798	1,370.0	401.0	1,496.0	3,267.0	42	12	46	100	546.6	160.0	596.9	1,303.5
Heifers 1-2 years	243	275.0	100.7	343.1	718.8	38	14	48	100	33.4	12.2	41.7	87.3
Heifer calves	260	275.0	100.7	343.1	718.8	38	14	48	100	35.8	13.1	44.6	93.5
Steer and bull calves	23	--	--	--	--	--	--	--	--	--	--	--	--
Bulls	13	--	--	--	--	--	--	--	--	--	--	--	--
Sheep													
Ewes, 1 year +	1,293	--	--	--	--	--	--	--	--	--	--	--	--
Feedlot lambs	30	42.0	--	36.0	78.0	54	46	--	100	0.6	--	0.5	1.1
Lambs and yearlings off pasture	1,210	--	--	--	--	--	--	--	--	--	--	--	--
Ewe lamb replacements d/	259	--	--	--	--	--	--	--	--	--	--	--	--
Rams and replacements	50	--	--	--	--	--	--	--	--	--	--	--	--
Hogs													
Pigs fed out e/	222	985.0	128.0	35.0	1,148.0	86	11	3	100	109.3	14.2	3.9	127.4
Poultry													
Layers (annual average)	29,943	79.0	19.0	11.0	109.0	73	17	10	100	1,182.8	284.5	164.7	1,632.0
Breeding flock	427	117.6	29.6	14.3	161.5	73	18	9	100	25.1	6.3	3.1	34.5
Broilers produced	60,115	5.7	2.4	.7	8.8	65	27	8	100	171.3	72.1	21.0	264.4
Turkeys raised	16,386	50.0	17.8	7.7	75.5	66	24	10	100	409.7	145.8	63.1	618.6
Turkey breeders	961	114.0	39.8	11.6	165.4	69	24	7	100	54.8	19.1	5.6	79.5
Other (residual)	--	--	--	--	--	--	--	--	--	168.8	2.6	2.9	174.3
TOTAL	--	--	--	--	--	--	--	--	--	4,258.2	874.6	1,715.1	6,847.9

a/ Assumes 20 percent replacement rate for beef cows 2 years and over.

b/ Estimate of number of feeder calves "warmed-up" from 400 to 600 pounds.

c/ Assumes 1 bull per 25 cows 2 years and over.

d/ Assumes 20 percent replacement rates for ewes 1 year and over.

e/ Assumes 72 percent of pigs saved.

Source: Concentrates fed

Beef cattle

Feedlot marketings - Hopkin and Kramer, [1965].

Others - Thomas and Braun, [1965].

Dairy cattle - Thomas and Braun, [1965].

Sheep - Cassard and Juergensen, [1963].

Hogs - Thomas and Braun, [1965].

Poultry - Thomas and Braun, [1965].

which are estimated at 20 percent of the number of beef cows 2 years and over rather than reported data. Similarly, "pigs fed out" are estimated at 72 percent of the reported figure for pigs saved.

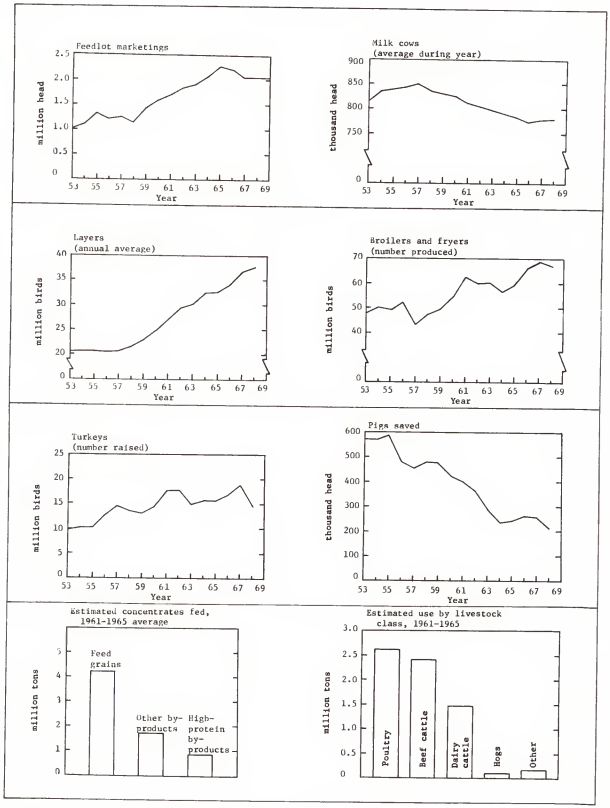
Data on feed consumption are given in Table 4 for: (1) concentrates fed per head; (2) the composition of the ration (grain, high-protein by-products, and "other" which includes wheat in addition to other by-products); and (3) total concentrates fed. In estimating concentrates fed per head, consideration was given to reported rations for particular weight gains or production levels, and then feed requirements were converted to a per head basis. Feeding levels for certain types of poultry and livestock include an allowance for replacement stock. For example, the feed per head for pigs fed out includes an allowance for maintenance of the breeding herd. The feed requirements for laying hens includes an allowance for maintenance of the breeding flock and for replacement pullets. Thus, the feeding levels are higher than would be reported in feeding experiments. The residual item in Table 4 allows for certain animals not included in the study, such as horses, and for small quantities that may be fed to livestock such as calves raised. The total quantities fed shown in Table 4 are equal to supplies for feeding shown in Table 2; however, it was noted that less accuracy is expected in the feeding levels for individual livestock types than for the aggregate, and adjustments were made in feeding rates to force this balance. To check the reasonableness of these data, feeding rates were applied to livestock numbers for individual years with results that were in agreement with aggregate feed availability. However, changes in feed conversion efficiency over time and in levels of feeding should be considered in applying these data for future years.

The estimated level of concentrates fed and quantities used by type of livestock are shown in Figure 2. Poultry consumed an average of 2.6 million tons; beef cattle, an estimated 2.4 million tons; dairy cattle, 1.5 million tons; and all other livestock, an estimated 0.3 million tons. The relative importance of feed grains and by-product feeds also is indicated in this figure.

The selection of the 1961-1965 period for analysis was dictated by the need for a base period for which data were available, especially for the by-product feeds. There is considerable delay in reports on rail shipments

FIGURE 2

Trends in Selected Livestock Numbers, 1953-1969; and Estimated Concentrates Fed and Use by Type of Livestock, 1961-1965 Average



Source: California Crop and Livestock Reporting Service [1969a,b] for livestock and poultry numbers. The quantities fed by class were estimated by authors.

for by-products, issued by the Interstate Commerce Commission. In an attempt to introduce current information, the trends in livestock and poultry numbers are indicated in Figure 2. These trends reflect only one state's reaction to the forces of interregional competition in the production of livestock and poultry products and the shipments of feed grains and by-product feeds to a feed deficit area.

Production of pork in the state is declining markedly, due to the alternative uses of feed in the state and the comparative advantage of the Midwest in pork production. In contrast, the number of layers is increasing and California is currently exporting eggs in contrast to a deficit position in the early 1960's. Although both broiler production and feedlot marketings have increased in recent years, increased competition is being felt from other producing areas. This study does not attempt to estimate the future competitive position of the California feed and livestock economy. Detailed studies of each industry in important producing regions of the country obviously are needed. Although these trends raise questions as to the future position of each of these industries, detailed analyses are clearly beyond the scope of this study.

Hay and Roughage

The availability of hay and roughage is of primary importance to the dairy cattle and beef cattle industries in California. Consumption of hay and pasture is given in Table 5 by type of livestock. The major source of data on hay consumption rates is the report by Thomas and Braun [1965]. In their report, livestock and poultry specialists were consulted in developing reasonable rations for various types of livestock. The pasture and grazing rates are based on data compiled by Hedges and Bailey [1952], and these rates appear reasonable for current conditions. Admittedly, it is difficult to obtain accurate estimates of beef cattle and sheep grazing on range lands where conditions may vary considerably from year to year. Thus, these estimates must be considered as rough approximations. Data on the hay supply and utilization are more reliable since they are based on published information of production and supply and on more reliable estimates of consumption by beef and dairy cattle.

TABLE 5

Hay, Pasture, and Grazing Use by Livestock in California: Total and Per Head Use, 1961-1965 Average

Type of animal	Number of head fed	Hay and pasture-grazing consumption per head		Total hay and pasture-grazing consumption	
		Hay	Pasture grazing	Hay	Pasture grazing
	thousands	pounds	AUM	thousand tons	thousand AUM's
Beef cattle					
Feedlot marketings	1,957	584	--	571.4	--
Beef cows, 2 years +	889	2,000	11.70	889.0	10,401
Heifer replacements, 1-2 years	308	1,400	↑	215.6	1,725
Calves raised	(785)	--		--	--
On feed	200	1,425	5.60 AUM	142.5	--
Other	585	--	Annual average	--	3,276
Bulls	36	1,400	↓	25.2	202
Dairy cattle					
Cows	798	10,795	4.50	4,307.2	3,550
Heifers 1-2 years	243	3,650	↑	443.5	1,361
Heifer calves	260	900	5.60 AUM	117.0	1,456
Steer and bull calves	23	900	Annual average	10.4	129
Bulls	13	9,000	↓	5.9	73
Sheep					
Ewes, 1 year +	1,293	16	2.35	10.3	3,039
Feedlot lambs a/	37	240	--	4.5	--
Lambs and yearlings off pasture	1,210	--	1.00	--	1,210
Ewe lamb replacements	259	16	2.30	2.1	596
Rams and replacements	50	16	2.30	.4	115
Hogs					
Pigs fed out	222	20 b/	--	3.7	--
Other (residual)	--	--	--	602.0	--
Supply	--	--	--	7,350.7	27,133

a/ 30,000 feedlot lambs + 7,500 4-H lambs.

b/ 20 pounds hay per cwt. product.

Source:

Hay

Beef

Feedlot marketings - Hoskin and Kramer [1965].

Calves on feed - Thomas and Braun [1965].

Data was obtained from various Agricultural Extension Service Personnel, University of California, Davis, as follows:

Other beef - Rueben Albaugh.

Dairy - Donald L. Bath.

Sheep - G. M. Spurlock.

Hogs - Hedges and Bailey [1952].

Pasture grazing - Hedges and Bailey [1952].

Feed Requirements Per Unit of Production

The previous tables present feed requirements per head and the aggregate for all livestock in the state. For some purposes, it is useful to express feed concentrate requirements in terms of pounds of feed per hundredweight of production (for eggs in terms of pounds of feed concentrates per 100 eggs). Such data are summarized in Table 6. Use of such data are illustrated in the following section. However, a statement of the development of such data is discussed briefly.

The total concentrate feed requirements per hundredweight of broilers is indicated as 270 pounds in Table 6. This is obtained by dividing the total liveweight production of broiler production (liveweight) by the total concentrates required to produce these broilers plus sufficient feed to maintain the breeding stock, and is expressed in terms of feed per hundredweight of broiler meat produced.

Calculations for other livestock and poultry are explained in footnotes to Table 6. However, estimation of the feed requirements for feedlot cattle require additional explanation. The average liveweight of commercial cattle slaughtered was 1,026 pounds and the average carcass weight of such cattle was 596 pounds for this period. It is impossible to obtain accurate information as to the average weight gain in feedlots. Based on information on daily gain, feed required per pound of gain, and estimated days on feed, we estimate that average gain in feedlots is approximately 390 pounds. The feed required for this weight gain is estimated to be 2,350 pounds of concentrates (Table 2) and 584 pounds of roughage (Table 3). Total feed per pound of gain is 7.5 pounds of which 80 percent is concentrates. Data provided in Table 6 give estimates of feed concentrates per hundredweight of weight gain; per hundredweight of liveweight; and feed concentrates per hundredweight of carcass weight. These estimates are based on the assumption that no concentrates are fed to these cattle prior to being placed on feed in the feedlot. California's ability to compete in the production of fed cattle depends critically on feeding efficiency, feed prices, and transportation rates for feed and meat. These considerations are discussed in the following section.

TABLE 6

Feed Concentrate Requirements Per Unit of Product for Major Poultry and Livestock Products, California, 1961-1965 Average[a]

Product	Conversion factor[b]	Feed grain required per cwt. of product (100 eggs)	High-protein by-product feed required per cwt. of product (100 eggs)	Other by-product feed required per cwt. of product (100 eggs)	Total concentrate feed required per cwt. of product[b] (100 eggs)
	percent	pounds			
Hogs					
Live	100	430.0	55.0	15.0	500.0
Fresh pork	58	729.7	95.0	25.9	850.0
Broilers					
Live	100	176.8	75.4	17.6	270.0
Ready-to-cook	73	242.2	103.3	24.1	370.0
Turkeys					
Live	100	293.2	108.9	40.1	442.0
Ready-to-cook	80	366.5	136.2	50.2	553.0
Eggs (fresh)	100	35.0	8.8	4.3	48.0
Milk (fluid)	100	13.1	3.8	14.3	31.0
Lamb-mutton					
Live	100	40.8	--	35.0	76.0
Carcass	50	81.5	69.9	--	151.0
Feedlot cattle					
Weight gain (390 pounds)	--	380.0	21.5	201.0	602.5
Average live weight (1,026 pounds)	100	144.4	8.2	76.4	229.0
Carcass weight (596 pounds)	58	249.0	14.1	131.7	394.8

a/ Feed requirements for hogs, broilers, and turkeys include sufficient feed to maintain breeding stock; for eggs include feed for replacement pellets; for milk include feed required per hundredweight for 3.8 percent butterfat milk; for lambs refer to feedlot fed animals only; and for beef cattle refer to feed for estimated weight gain of 390 pounds for feeders averaging 626 pounds. The feedlot cattle ration is 2,350 pounds of concentrates (Table 2) plus 584 pounds of roughage (Table 3) giving a total ration of 2,934 pounds, or an estimated 7.5 pounds of feed per pound of gain (6.0 pounds of concentrates per pound of gain).

b/ Conversion from live weight to dressed weight.

COMPOSITION OF LIVESTOCK PRODUCTION IN CALIFORNIA

The composition of livestock production in any region depends on such factors as the level of regional demand, transportation costs for feed and livestock products, and the comparative advantage among regions in producing feed versus other products, and in feed conversion efficiency in producing livestock products. We have noted the feed-deficit position of California. This section focuses briefly on California's surplus or deficit position in regard to livestock products and factors that influence the composition of production in a feed-deficit state.

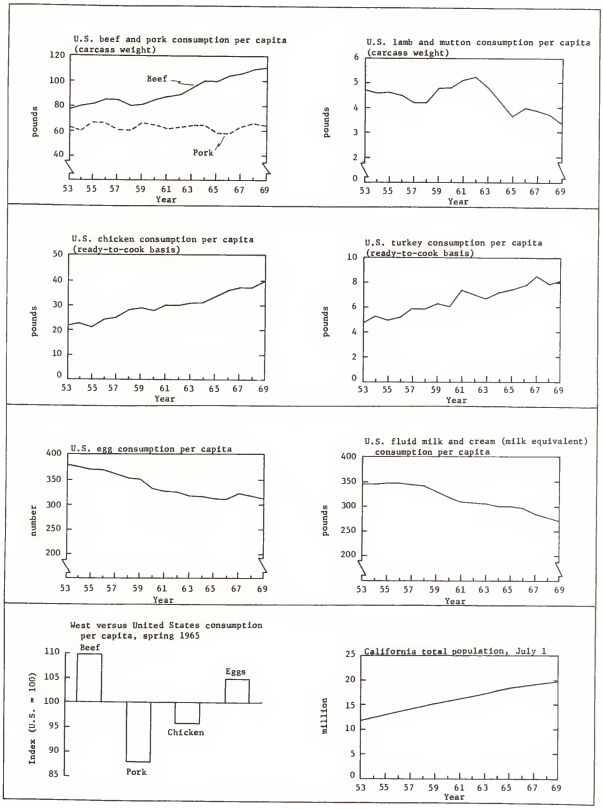
Trends in the U.S. Consumption of Livestock Products

Data are not reported for consumption of livestock products by individual states due to the difficulty of obtaining information on quantities shipped among states. It is possible to obtain some insight as to changes by inspection of trends in per capita consumption for the United States, as shown in Figure 3. For the years 1953 to 1969, consumption per capita has increased for beef, chicken, and turkey meat whereas pork consumption has remained relatively constant. Per capita consumption of eggs, milk, and lamb has decreased over this period.

Consumption of various products differs by region. Information reported by Hiemstra [1970] indicates that for the Western Region, beef consumption per capita was above that for the nation, based on 1965 survey data. This was true also for eggs, as shown in Figure 3. Pork consumption and chicken consumption, however, were below the national average. California consumption per capita undoubtedly varies from that reported for the Western Region. We turn next to the sources of supply of livestock products in California.

FIGURE 3

U.S. Per Capita Consumption of Major Livestock Products, 1953-1969; West Versus United States Consumption Per Capita, Spring 1965; and California Population Trends, 1953-1969



Source: U.S. Economic Research Service [1969]; Hiemstra [1970]; and California Department of Finance [1970].

Sources of Supply for Selected California Livestock Products

Beef and Pork

Beef and pork supplies in California for 1964 are shown in Table 7. For that year, the number of trucks entering California border inspection stations were reported, and sample data were obtained as to the composition of shipments among beef, pork, and other meat products. Such information is no longer reported.

In 1964, California slaughter of beef and dairy animals accounted for 75 percent of the total beef supply, with shipments from other states accounting for 21 percent, and imports for 4 percent. Note that in addition to meat inshipments, animals shipped into the state accounted for 14 percent of supplies. Thus, California feedlots and other sources provided 61 percent of the supply. In addition to the deficit position in meat and slaughter animals, California depends on other states for about 70 percent of the supply of stockers and feeders. The feedlot industry thus must maintain high levels of efficiency to compete with other regions for feeder cattle and feed grains. Although no data are available for meat shipments into California in recent years, it would appear that this source may be of increased importance based on trends in California feedlot marketings (Figure 2), in United States beef consumption per capita, and in California population trends (Figure 3). Changes also may have occurred in California beef consumption per capita. For 1964, total supply per capita is 130 pounds, based on data in Table 7, as compared with a U.S. level of 99.8 pounds, and an estimated 110 pounds for the Western Region.

Pork supplies in 1964 are estimated at 2 percent from California hogs, 21 percent from inshipments for immediate slaughter, and 77 percent from truck and rail shipments from other states. The supply per capita for 1964 is 57.5 pounds which is equal to 88 percent of U.S. consumption per capita for that year. The 1965 survey data indicated that pork consumption in the West is 88 percent of the U.S. average, and this appears a reasonable estimate for California also. Based on recent trends in pigs saved (Figure 2) and on other considerations to be noted, it is expected that California will continue to depend on other regions for its pork supply.

TABLE 7

Sources of California Beef and Pork Supply, 1964

Source	Beef supply		Pork supply	
	Dressed weight	Percent of total	Dressed weight	Percent of total
	million pounds	percent	million pounds	percent
California slaughter				
California feedlots	1,233 a/	52	--	--
Other California sources	218 b/	9	23 e/	2
Inshipments for immediate slaughter	325 c/	14	214	21
Total	1,776	75	237	23
Meat inshipments				
Truck	480 d/	21	636 d/	61
Rail	--	--	160 f/	15
Total	480	21	796	77
Meat imports	98	4	2	--
TOTAL SUPPLY	2,354	100	1,035	100

a/ Feedlot marketings (2,357,000 head) times average dressed weight (598.2 pounds) for California commercial slaughter.

b/ Estimate based on total commercial slaughter less feedlot marketings plus farm slaughter of 7 million pounds.

c/ Estimate based on number shipped into California times average dressed weight.

d/ Estimate based on number of trucks entering the state in 1964 carrying meat and meat products (28,447); on sample data for average weight load (39,250 pounds); and on estimated distribution between beef and pork. See Logan and King [1966, p. 44] for more details.

e/ Residual from reported slaughter less inshipments for immediate slaughter.

f/ Rough estimate based on rail inshipment data and consumption level estimate.

Source: California Crop and Livestock Reporting Service [1966], [1969a]; U.S. Interstate Commerce Commission [1966]; Federal State Market News Service [1965].

Poultry Products

Egg consumption in the West is estimated at 105 percent of the U.S. average based on the 1965 survey data. In recent years, California has produced in excess of consumption needs for the state, and shipped to other states about 5 percent of its production. Rough calculations would indicate that the level of California consumption exceeds that for the entire Western Region.

Turkey meat is produced in excess of California consumption. Based on estimated consumption levels in California in 1961, as reported by Bawden, Carter, and Dean [1966], about 60 percent of California production is shipped out of the state.

Broiler meat consumption per capita in the West is reported at 95 percent of the U.S. level for 1965. Accurate estimates of consumption in California are not available. However, Siebert [1969] provides data for 1968 on average weekly truck receipts of ice-packed, ready-to-cook fryers, delivered to San Francisco and Los Angeles from out-of-state origins. The estimated total of such inshipments for 1968 is 307 million pounds, as compared with California broiler and fryer production of 206 million pounds, expressed on a ready-to-cook basis. California faces continued competition from the Southeast broiler producing areas in meeting the growing market for chicken.

Milk

California produces all fluid milk requirements. However, it is deficit in terms of certain manufactured products such as cheese and butter. Data are not available as to the extent of shipments into the state of these products, and no attempt will be made for a complete discussion of the complex problem of milk marketing orders and their effects on production and utilization in the state.

The next section provides a brief introduction to factors which influence the composition of production in California.

Factors Affecting the Composition of California Livestock Production

It has been noted that California is a feed deficit area both with respect to feed grains and by-product feeds. For livestock products, it is deficit in beef, pork, broiler meat, and certain manufactured dairy products, but is self-sufficient or in a surplus position for fluid milk, eggs, and turkey meat. A complete appraisal of factors influencing the level and composition of livestock products is far beyond the scope of this report. However, it is clear that such factors include the demand for the various products in a region; the comparative advantage in producing feed grains versus specialty crops with given land resources; the transportation rates for feed grains and for meat and other products; and regional differences in feed conversion efficiency and costs for various livestock products.

Here we suggest a simplified approach to partially explain the nature of production in California; namely, what is the ranking of livestock products as to the orientation of production as to proximity to the market or to the feed grain supply? Such a ranking provides insight as to the probable use of feed among production alternatives, especially in a feed deficit area. The information required includes: (1) feed requirements per 100 pounds of product, as developed in Table 6; (2) transportation rates per 100 pounds of product; and (3) the transportation rates per 100 pounds of feed concentrates from relevant surplus areas to California. We inspect the following relation for each product:

$$\text{(Feed per 100 pounds of product)(Transportation cost per 100 pounds of feed)} \gtreqless \text{(100 pounds of product)(Transportation cost per 100 pounds of product).}$$

It will be convenient to rewrite the above relation as follows:

Ratio A		Ratio B
$\dfrac{\text{feed per 100 pounds of product}}{\text{100 pounds of product}}$	$\lesseqgtr$	$\dfrac{\text{trans. cost per 100 pounds of product}}{\text{trans. cost per 100 pounds of feed}}$

Livestock production is a weight-losing process in the sense that the tonnage of feed inputs exceeds the tonnage of product. However, the amount of feed required per 100 pounds of product varies considerably among the various products. In general, production tends to be oriented to the raw material source

to some degree. For example, in beef production, consideration must be given to range production of feeders as well as concentrate feeds, hay, and other roughages. Here we simplify to consider the shipment only of one input, feed. Production will tend to be feed-source oriented if the ratio A is greater than B; it will have a tendency to be market oriented if B exceeds A; and it will be a matter of indifference if these ratios are equal.

These ratios are shown in Table 8 for several important livestock products. Pork production is highly feed-source oriented especially for the shipment of pork rather than as live hogs. Milk products range from feed-source orientation of the processed items like butter to the market orientation in production of fluid milk. It is noted that the concentrate requirements of 32 pounds per 100 pounds of milk is associated with an adequate roughage supply in the area. Broiler production and egg production, with all other costs equal, would tend to be feed-source oriented but to a lesser extent than for pork. The California broiler industry has been faced with increased competition from Arkansas and Mississippi due to their favorable feed transportation rates, low labor costs, and an efficient industry. The California egg industry has maintained an export position in recent years, but may face increasing competition in the future. The California feedlot industry, as noted, depends on inshipped feeders as well as feed concentrates, and the simple comparison of ratios may be misleading. However, the industry has maintained a strong position due to very large, efficient feedlot operations. As with several other livestock industries, the future will depend on maintaining this competitive advantage over other regions which may be located closer to feed concentrate supply areas and to feeder cattle supply areas.

In summary, our major purpose of presenting this report is a background information for projections studies of California agriculture. More detailed studies are required to more fully evaluate all factors influencing interregional competition in the feed-livestock industry. However, the above ranking of industries as to feed-source orientation provides a rough indication of the competitive pressures on certain livestock products.

TABLE 8

Relative Feed-Supply Orientation of Livestock and Poultry Products

Item	Conversion of live to product weight	Feed per 100 pounds of product	Ratio A: Feed per cwt. / 100		Ratio B: Transfer cost / cwt. product / Transfer cost / cwt. feed[a/]
Hogs, live	100	500	5.0	>	3.0[b/]
Fresh pork	58	850	8.5	>	2.3[c/]
Milk, fluid	100	31	.3	<	3.4[d/]
Butter	4.7	675	6.8	>	3.5[d/]
Broilers					
Ready-to-cook	73	370	3.7	>	3.3[e/]
Eggs, fresh	100	369	3.7	>	2.5[f/]
Feedlot cattle					
Weight gain[g/]					
Live	100	602[g/]	6.2	>	3.0
Carcass beef	58	--	--	>	2.3[c/]
Total weight					
Live	100	229[h/]	2.3	<	3.0[b/]
Carcass beef	58	395	4.0	>	2.3[c/]

a/ Feed transfer cost taken at $0.75 per cwt. representing a shipment of corn or milo from Kansas City to California.

b/ Live animal transportation cost of $2.27 per cwt. representing a shipment from Omaha to California.

c/ Carcass beef transportation cost of $1.94 per cwt. representing a shipment from Omaha to California.

d/ Milk and butter.

e/ Broiler transportation cost of $2.50 per cwt. representing a shipment from Arkansas to California.

f/ Egg shipment price of 3 cents per dozen (1.57 pounds) converted to cost of $1.91 per cwt.

g/ Weight gain of 390 pounds for an average 636 pound feeder reaching average live weight of 1,026 pounds.

h/ Feed fed in feedlot of pounds divided by average live weight of slaughter of 1,026 or pounds per cwt.

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